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ABSTRACT

This analysis involved the ten events of the men's decathlon in all performances which scored 8,000 points or higher, based on the 1962 Scoring Tables of the International Amateur Athletic Federation. It attempted to (1) determine the interrelationships among the events and the final scores, (2) look for areas of difference compared to sub-8,000 point performers, and (3) decide whether the performance levels can be predicted on the basis of significantly fewer events. Compared to earlier performances, the results were more balanced in relation to the scoring tables, and the correlations among and between the events and the final scores were generally lower than in previous studies. In addition, it seems that elite-level athletes turn in a more balanced performance in their non-specialty events than do lesser competitors, and that in training the higher-level decathlete, early attention towards developing all ten events equally towards an optimal skill level should be encouraged. It also appears that the use of predictive formulae are of little value when considering elite-level competition. (Author/LH)

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AN ANALYSIS OF ELITE DECATHLON PERFORMANCES

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This study was designed to investigate aspects of elite-level decathlon performance, with primary objectives of: first, determining the interrelationship among the events and the final scores; second, looking for areas of difference compared to non-elite performers; and third, deciding whether the final performance levels can be predicted on the basis of significantly fewer events.

Elite-level decathlon performance was defined as achieving a score of 8,000 points or higher based on the 1962 Scoring Tables of the International Amateur Athletic Federation (IAAF). Performance marks in the ten events of the decathlon were collected along with their final scores for all decathlons reaching the 8,000 point level through 1977. As rules have changed and technological advances have affected the performance areas, the systems of timing have been revised. Current rules require fully automatic timing (FAT) systems wherever possible, removing human error from timing. This also results in slower times and, therefore, lower decathlon scores. Alternative scoring tables using the 1/100th of a second FAT were adopted by the IAAF in 1971. Consequently, all potential subject decathlons were collected and scored under two systems:

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fully automated timing (FAT) and manual timing (MT). Any manual score was converted by adding the suggested IAAF corrections of .24 of a second to the times for the 100 meter dash, 110 meter hurdles, and 1500 meter run, while .14 of a second was added to the 400 meter dash time. The events were then rescored. To convert the FAT times to MT, the process was reversed and the times rounded to tenths of a second by IAAF rules.

The result was 104 FAT decathlon performances by 31 athletes, with 188 MT decathlons performed by 56 athletes. For the purposes of simplicity, only the FAT marks were used in this study. Using a computer and SPSS programs, means and standard deviations were computed for 11 variables: the ten events and total score for each performance. The raw data were also studied in two other forms: (1) standard scores for each event, based on the $\bar{X}$ and s for the entire group, and (2) the IAAF scores for each event. These versions of the data permitted comparison to earlier studies which used standard scores and, at the same time, permitted a study of consistency of level of performance as the athlete sees it, reflected in point scores on the IAAF tables. These versions, along with the raw data, were also treated to produce Pearson correlations between each combination of variables, then a factor analysis was run using both raw data and standard scores. The data were studied for two groups: the total number of performances (n=104) and the best performance of each athlete (n=31). Finally, a regression analysis was run with the raw data to see if a

predictive formula was found which gave reasonably accurate predictions based on performances in a small number of events. The results of these statistical studies were compared to earlier decathlon studies.

Generally speaking, the correlations between pairs of events were lower than in earlier studies, though there were exceptions, but these differences may simply reflect weaknesses in sampling technique in the earlier studies. Linden's (1977) study used many Olympic decathlon performances, but it inaccurately assumed that using the performances of Olympic performers was the same as using elite marks, neglecting to note that every nation is permitted to enter one competitor in every event, regardless of his competitive level, resulting in some cases in Olympic competitors who could not succeed at the advanced high school level in the United States.

A second weakness lies in using performances back to 1948, so that performances in the study were made under three different scoring tables of the IAAF (the 1934, 1954, and 1962 tables) and included a time when decathletes were less often specialists in that event. The different tables are a consideration primarily because the decathlete plans his training and sets his goals depending upon where he can gain the greatest point value from the tables. This scoring edge shifts in events from one table to its successor. As of yet there is no genuinely accurate scoring table in comparing a running event mark to a field event mark, what we might call the apples and oranges of track and field.

As an example, today's decathlete emphasizes / the high hurdles and pole vault, which are relatively "easy" point events, while limiting his work in the 1500 meters, a very "hard" point event. Matters are complicated by a shifting back and forth in the tables between rewarding and penalizing improvements in performance at high levels. Thus, the researcher must not lose sight of the importance of the scoring table in influencing the performance in any given event, for the athlete's goals are set based on the value of those performances in the tables and the relative training cost of achieving a given mark in one event, compared to another. The athlete faces the same quandry in developing his body, for he can run faster and jump higher with a lighter body weight, but will lose points in the throwing events. If he gains much weight for the throws, he weakens his runs and jumps. Consequently, training and performance in the decathlon are aspects of a continual juggling act, balancing every action with its counteracting effect on the other elements of performance. This juggling affects the resulting marks most strongly.

Mean performances may be most meaningful in terms of IAAF scores. The highest mean was the pole vault, based on a table produced just before the fiberglass vaulting pole became popular. When the table was approved, 1000 points was almost the world record, but that level of performance had become common by the time of the Olympic games two years later. The 1500 meter table, the lowest mean event, by contrast, is

very reluctant to produce comparable point scores. If we disregard these two events, the highest mean for an event is 889 points and the lowest is 768 points, compared to a total event mean of 813 points, a fairly narrow scope of scoring with standard deviations generally in the 45 to 65 point range. These indicate fairly balanced scoring from event to event, given the vagaries of the scoring tables.

An attempt to produce a predictive regression equation could not be called successful. Based on all performances, an equation using three events (the high jump, 400 meters, and discus throw) yielded a multiple r of only .56. An equation based on the best mark of each individual used the same three events and gave a multiple r of .76, which still resulted in considerable predictive inaccuracy.

The basic conclusions suggested by the analysis of the data are the following points:

1. While the elite decathletes have specialty events, just as do the lower-level decathletes, their other events show far less scoring variance about that level than those of the less-skilled performers. Elite performance, therefore, would appear to be more a factor of the balanced development of the athlete's skills across the ten events than due to any exceptional performances in a few specialty events. This observation agrees with Sykes' (1971) study of the 1968 Olympic decathlon.

2. The more balanced nature of the performances of the elite decathletes yields generally lower correlations among the involved variables than is

true for less skilled performers.

3. The greater balance of performances by elite decathletes renders the use of multiple regression predictive techniques of questionable, if any, value.

4. To develop the elite decathlete, attention must be paid to a balanced development of the athlete's abilities across all ten events until they reach an optimal level, after which the specialty events can be emphasized. This observation agrees with the so-called "West German school" of decathlon training, led by Friedel Schirmer, which prefers not to permit the decathlete to develop specialty events until he can achieve a balanced effort at the 7,000 point level.

5. The need is still clear for a more realistic statistical measure of comparative performances from one event to another. The 1962 IAAF table is still a crude instrument, inconsistent with the realities of improvements of human performance in many events. The author has had access to versions of Gerry Purdy's work toward developing a more realistic computer-based version of the table for the IAAF, which may be putting the new table into effect within the next few years. It is a step in the right direction.

6. More studies of this nature might consider more subtle differences and relationships in elite athletic performance. Unfortunately, at times researchers forget that sport research should be done by experts, and sport researchers at times have very inexpert understandings of the factors

which contribute to or affect sporting performances, compared to the practical acquired knowledge of coaches and athletes. More sport research should be conducted which utilizes this large body of experts at differing levels.

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Table 1

Electronically-Timed Performances

A. All Performances, n= 104

	Raw Scores		Standard Scores		IAAF Scores	
	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
100 Meters	10.98	.21	501.88	98.39	811.16	50.83
Long Jump	7.35	.27	498.36	98.66	889.80	53.69
Shot Put	14.68	.89	500.26	100.02	768.69	53.04
High Jump	1.97	.08	505.78	96.43	834.21	66.93
400 Meters	48.80	1.02	504.28	100.06	861.06	48.39
110 Meter Hurdles	14.81	.37	500.57	100.54	870.25	39.86
Discus Throw	45.74	2.62	499.81	100.02	794.25	48.49
Pole Vault	4.44	.25	499.23	101.20	916.82	62.08
Javelin Throw	64.86	6.03	499.45	98.79	818.01	71.05
1500 Meters	4:33.97	13.36	499.95	100.05	567.26	85.50
Score	8133.79	116.18			813.38	

B. Individual Performers, n= 31

100 Meters	10.95	.20	499.03	99.11	817.03	48.66
Long Jump	7.36	.23	501.48	99.04	893.48	45.78
Shot Put	14.77	1.04	499.71	100.22	773.61	62.25
High Jump	1.98	.08	500.74	99.75	839.42	69.06
400 Meters	48.77	1.14	496.94	100.55	862.81	53.22
110 Meter Hurdles	14.89	.43	497.35	100.51	861.10	44.82
Discus Throw	45.31	3.22	500.03	100.19	786.13	59.98
Pole Vault	4.45	.26	500.10	101.70	919.68	64.52
Javelin Throw	65.37	6.77	499.94	100.01	823.55	79.43
1500 Meters	4:31.57	10.70	499.58	97.83	581.58	70.07
Score	8171.61	149.57			817.16	

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Table 2

Correlations Based on Standard and Raw Scores

Event	LJ	SP	HJ	400m	HH	DT	PV	JT	1500m	Score	Study
100 Meters	.59	.35	.34	.63	.40	.28	.20	.11	-.07		L
	.443	-.022	-.202	.607	-.110	-.140	-.256	-.173	-.320	.175	A
	.416	-.087	-.090	.463	.008	-.158	-.006	-.321	-.119	.247	B
	-.443	.023	.202	.591	-.110	.141	.256	.174	-.320	-.175	C
	-.416	.087	.091	.464	-.032	.159	.006	.321	-.099	-.247	D
Long Jump		.42	.51	.49	.52	.31	.36	.21	.09		L
		-.155	.046	.340	-.120	-.320	-.204	-.242	-.336	.087	A
		-.224	.174	.317	.040	-.157	-.131	-.325	-.262	.163	B
		-.154	.047	-.350	.120	-.320	-.205	-.234	.338	.087	C
		-.224	.173	-.351	-.029	-.158	-.130	-.325	.278	.163	D
Shot Put			.38	.19	.36	.73	.24	.44	-.08		L
			.168	-.378	-.309	.495	-.146	.120	-.405	.107	A
			.098	-.426	-.302	.641	-.372	.135	-.305	.114	B
			.168	.400	.309	.495	-.146	.121	.404	.107	C
			.097	.428	.291	.641	-.373	.135	.376	.113	D
High Jump				.29	.46	.27	.39	.17	.18		L
				-.297	-.004	-.021	.133	-.221	-.082	.262	A
				-.163	-.005	-.071	.146	-.093	.154	.344	B
				.296	.007	-.021	.133	-.228	.082	.262	C
				.177	.018	-.071	.148	-.093	-.104	.344	D
400 Meters					.34	.17	.23	.13	.39		L
					.025	-.298	-.240	-.003	-.026	.214	A
					.052	-.345	.110	-.128	.271	.364	B
					-.019	.291	.216	.088	.032	-.216	C
					.056	.406	-.156	.173	.316	-.348	D
110m Hurdles						.32	.33	.18	.00		L
						-.123	.004	-.034	.214	.150	A
						-.180	.131	-.130	.145	.195	B
						.123	-.003	.038	.214	-.150	C
						.167	-.123	.092	.092	-.188	D
Discus Throw							.24	.34	-.02		L
							-.106	.184	-.115	.261	A
							-.223	.176	-.144	.278	B
							-.105	.178	.114	.261	C
							-.224	.178	.227	.280	D
Pole Vault								.24	.17		L
								-.143	.151	.190	A
								-.089	.272	.328	B
								-.140	-.150	.189	C
								-.089	-.330	.328	D
Javelin Throw									-.00		L
									-.130	.245	A
									-.218	.241	B
									.127	.243	C
									.236	.241	D
1500m										.219	A
										.235	B
										-.220	C
										-.180	D

L= Linden, 1977 n=160 (Scaled Scores)
A= Scaled ET 8k n=104
B= Scaled ET 8k n=31
C= Raw ET n=104
D= Raw ET n=31

Table 3

Mean IAAF Scores

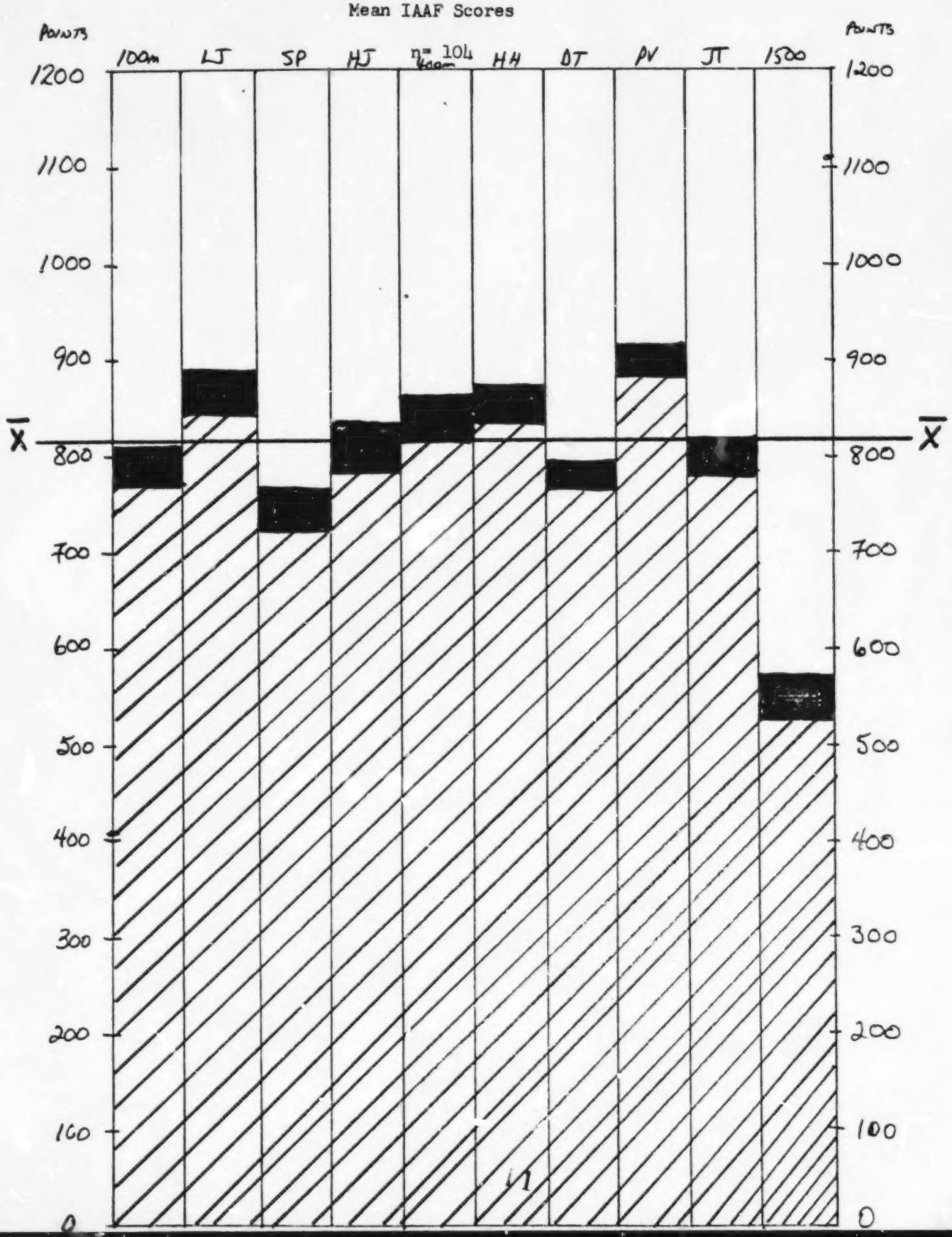

Table 4

Mean IAAF Scores

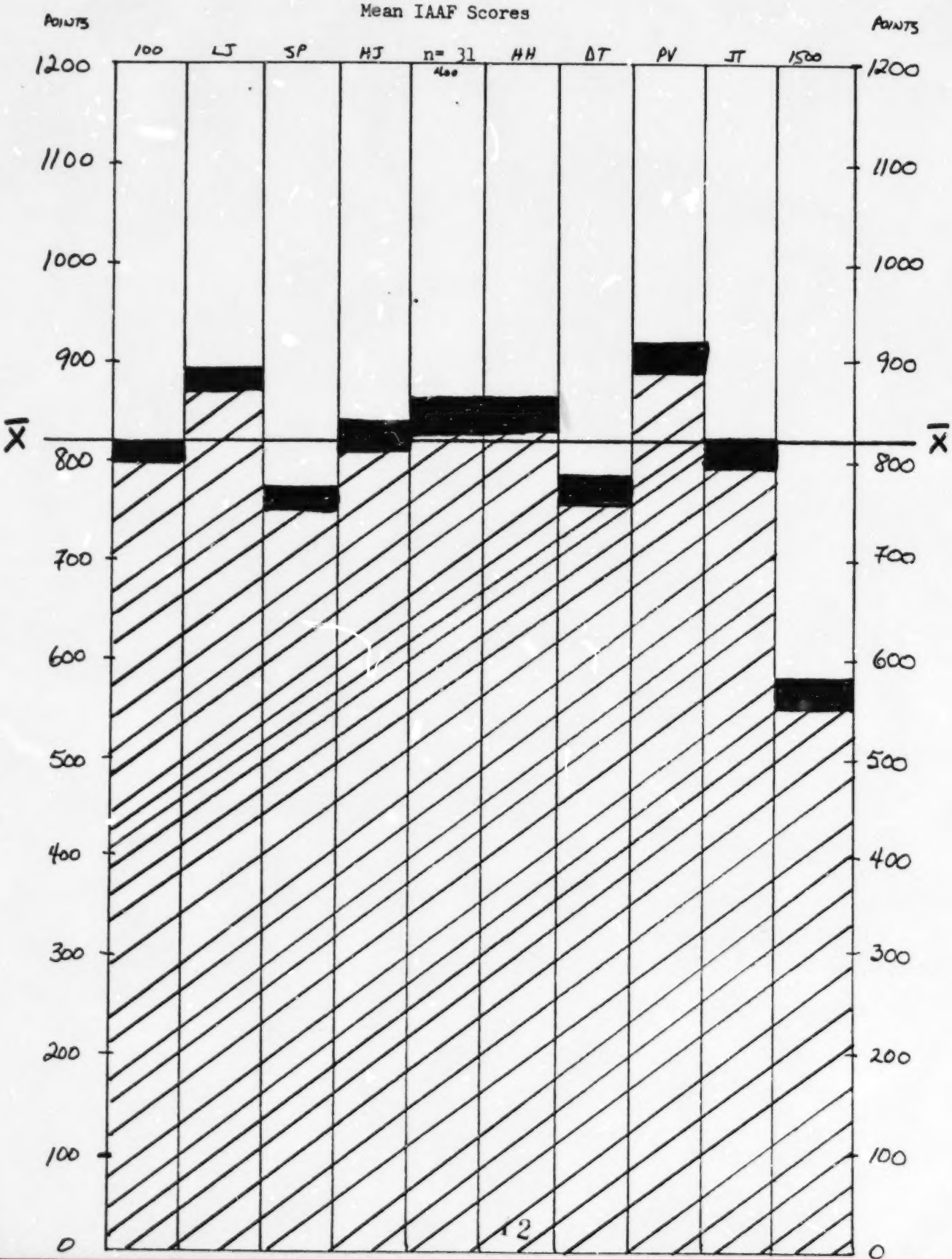

Table 5

Regression Equations

A. Based on all performances, n= 104

SCORE= (612.2838 * HJ) - (52.60995 * 400m) + (17.84737 * DT) + 8675.443

Multiple r= .56 for .80, need 7 events (.85)
for .90, need 8 events (.90)

Performers Code no.	Predicted	Actual	Difference
7801	8169	8467	-298
7802	7598	8094	-496
7803	8085	8031	54

$\bar{X}$ error = 283 points or -247

B. Based on best individual performances, n= 31

SCORE= (948.8274 * HJ) - (88.59051 * 400m) + (27.47418 * DT) + 9368.117

Multiple r= .76 for .80, need 4 events (.82)
for .90, need 6 events (.91)

Performers Code no.	Predicted	Actual	Difference
7801	8238	8467	-229
7802	7959	8094	-135
7803	8101	8031	70

$\bar{X}$ error= 148 points or -98